Role of telecommunication in mobility

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Transformation of the automotive industry

Technological developments and **evolving business models** are challenging :

Electrification & Connection	Sensor & elec. Architecture Advancements	Over-The-Air update (Telemetry)	AI Algorithms
Mobility Business Models	Machine Learning	Self-driving Cars	*and more*

!

What do they have in common?
They are disrupting the conventional automotive ecosystem **and** could slowly making it obsolete.

Upcoming changes in the automotive industry

Process Transformation

The process to adopt a new innovation requires

- ✓ Time (4-6yrs)
- ✓ Money (testing)
- ✓ Qualification
- ✓ Certification

Mindset Transformation

**From
traditional, conservative mindset (inflexible R&D)**

**To
"out-of-the-box" thinking**

**Addressees
OEMs and Tier 1 suppliers**

> **New Players enter the market, disrupting existing business models and established players – and the existing players look for new businesses**

Disruption & new opportunities

Key Technologies

- **Ubiquity Connectivity (4G; LTE-V2X; 5G)**
- **New User Interfaces:** Voice is key!
- **Computing Power: Data Analytics, Artificial Intelligence & Machine Learning**
  - in the car (OEM/1st tier supplier)

New innovative opportunities

New Key Players and Services enter the market

OTT Player

Google · UBER

amazon · lyft

Established Players New Services

CAR2GO · DriveNow · here

NOKIA · ERICSSON · HUAWEI · TESLA

Change of Customers Value Perception

Today

- Ownership of cars
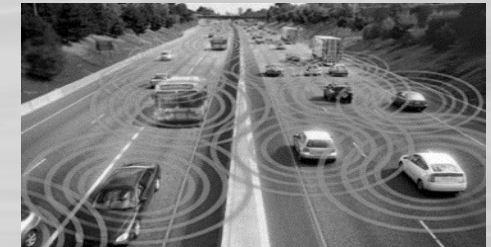- Acceleration
- Fuel consumption
- Driving Dynamics

Future

- "Sharing" (MaaS)
- Comfort
- Infotainment
- Advanced Security

Potential new services

- Security and Traffic Management Services
- Entertainment Services
- Comfort Services
- Sharing Services
- E2E Mobility Services

Connectivity remains a driver of the connected car business

McKinsey&Company

McKinsey states that today's car processes **25 GB** of **data per hour**

intel

Intel expects that **4000 GB** of **daily data** will be **processed** in an **autonomous car in 2020**

Audi

Audi expects the need for **1 GB** of **daily data** volume **per car** for **in-car content and digital services** by 2019

HARMAN

Harman predicts that **by 2020 166 GB per day** will be created **per person** through devices, sensors and machines

Mobility of the future

V2V

V2I

V2N

V2P

Vehicle-to-vehicle
e.g. collision avoidance safety system

Vehicle-to-infrastructure
e.g. traffic signal timing /priority

Vehicle-to-network
e.g. real-time traffic/routing, cloud services

Vehicle-to-pedestrian
e.g. safety alerts to pedestrians, bicyclists

From Testbed facility to Usecases

5G Mobility Lab | Testbed Aldenhoven

Teleoperated Driving

Our testbed activities

Technology Focus

- 5G Introduction
- Edge Computing & Geo Messaging
- LTE V2X
  - Vehicle-to-Vehicle (V2V)
  - Vehicle-to-Infrastructure (V2I)
- Seamless Coverage
- VF Automotive sensors and telematics

Aldenhoven

- Test track for highway and city infrastructure
- latest LTE Advanced towards 5G, Mobile Edge Cloud with all major vendors & car manufacturers
- Connected to Vodafone Innovation Park
- 5GAA global testbed

Düsseldorf "KoMoD"

- **Focus:** Parking, Highway, City (E2E view)
- **Projects:**
  - Mobileye data insights
  - Smart & Valet Parking
  - Mobile Edge Computing, NB IoT

Dresden "HarmonizeDD"

- **Focus:** Autonomous driving in City
- **Projects:**
  - LTE V2X in city
    Connect city cloud with car cloud
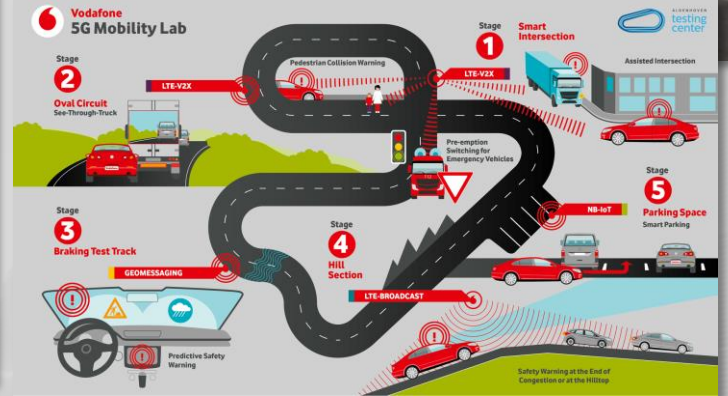 - Highly automated and autonomous driving

A9

- **Focus:** Highways, Assisted & Autonomous driving
- **Projects:**
  - LTE V2X testing
  - Motorway Use cases: Platooning, Warnings, Traffic Efficiency

5G Mobility Lab

Teleoperated driving